



# Waste = Food



New Belgium Brewing Company  
Process Water Treatment Plant and  
Bio-gas Fueled Combined Heat + Power  
Plant



# Some Company Facts:

- Founded in 1991
- Manufacturing business = high capital investment, lower double digit GP
- 175 co-workers, \$42M sales
- 2.7 MWhr annual electric power needs
- 40 million gallons water purchased

# 100% Wind Powered Since 1999

- Started as a CO<sub>2</sub> reduction effort
- 2000 tons then, over 3000 tons in 2003
- \$40,000 additional cost (CY 2000)
- Staff vote
- Easy to implement
- Strengthening of corporate fabric





# Our Core Values and Beliefs

W

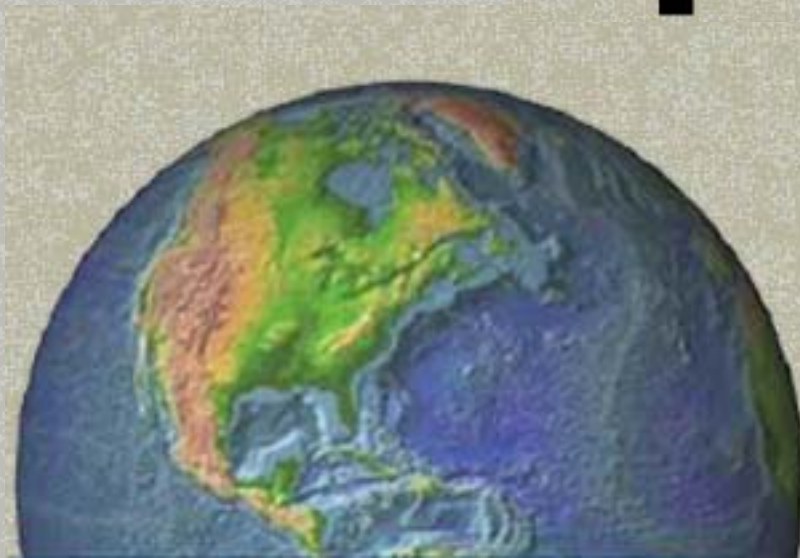


-  Producing world-class beers.
-  Promoting beer culture and the responsible enjoyment of beer.
-  Continuous, innovative quality and efficiency improvements.
-  Transcending our customer's expectations.
-  Environmental stewardship: minimizing resource consumption, maximizing energy efficiency and recycling.
-  Kindling social, environmental and cultural change as a business role model.
-  Cultivating potential: through learning, participative management and the pursuit of opportunities.
-  Balancing the myriad needs of the company, staff and their families.
-  Committing ourselves to authentic relationships, communications and promises.
-  Having fun.



# Triple Bottom Line

- Planet
- People
- Prosperity





# Why On-site Process Waste Water Treatment?

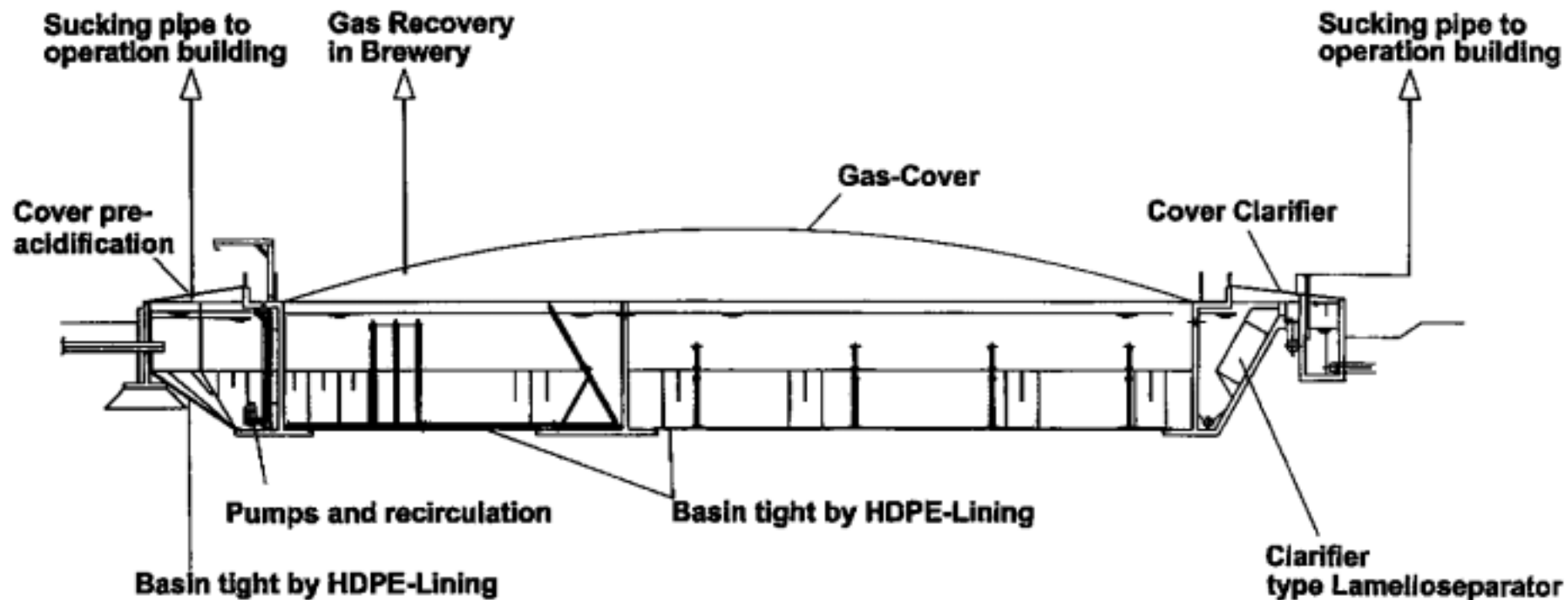
- Brewery effluent is strong, 6000...9000 PPM BOD, 20M gallons / year
- Substantial cost to use municipal waste water treatment
  - Up to \$7.5M plant investment fee
  - Approx. \$20,000 monthly surcharge at current production level
- Reduction of City plant investment fee similar to cost of on-site plant



# Why Anaerobic Treatment?

- Municipal = aerobic process, vulnerable to large beer discharges
- Strong effluent best suited to anaerobic digestion method
- Lower energy cost to operate
- Bio-gas production

# Anaerobic-Reactor



SK.3025.000.4  
17.04.01 / Ya

ANAEROBIC-REACTOR  
SMELL PROTECTION



VON NORDENSKJÖLD  
Verfahrenstechnik  
D-85658 EDMATING/GERMANY KILLISTR. 3

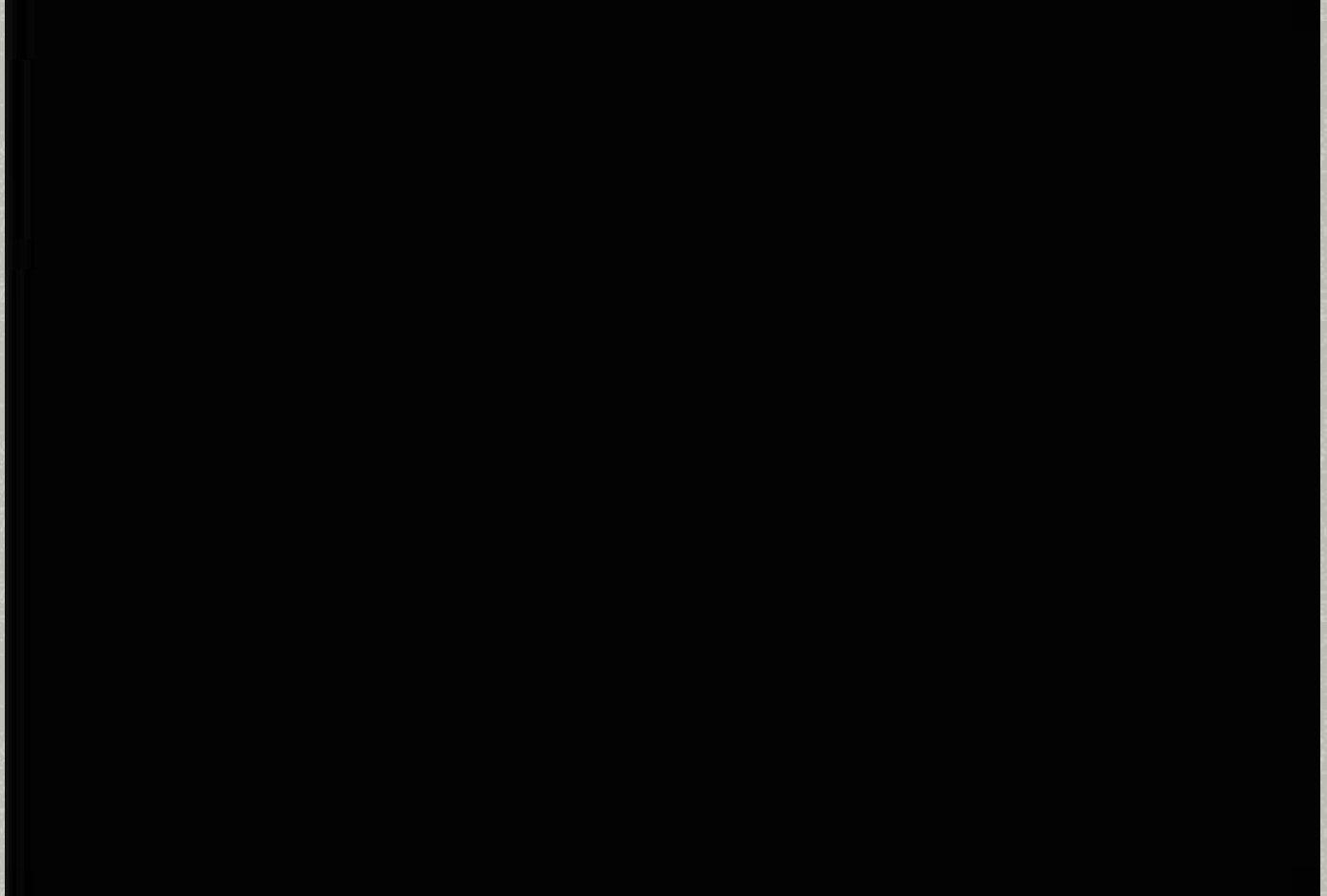


# The PWTP





# The PWTP





# What to Do With the Bio-gas?

- Flare-off

- Methane is a much more destructive greenhouse gas than CO<sub>2</sub>

- Fuel cell

- Our supplier had no experience, industrial scale equipment unproven

- Combined Heat and Power

- Developed technology
- Heat extraction



# The CHP Plant





# The CHP Plant

- 24-liter internal combustion piston engine





# The CHP Plant

- Natural or bio-gas capable
- 880 kW gas input
- 310 kW mechanical output
  - 292 kW electrical at 0.8 pf
- 495 kW thermal output
  - Combined cooling jacket and exhaust gas
  - Used in series to generate higher water temperature



# Economic Value of Combined Heat + Power

- Best use *for us* is to reduce electric utility co-incident peak and facility peak demand charges
  - Co-incident peak up to \$5000/month
  - Facility peak up to \$1000/month



# Quick Economic Justification

- Based on purchased natural gas at \$5.30 / MBtu
- 14 hour per day run time to cover co-incident and facility peaks
- Gas cost \$7540 / mo
- Co-incident peak demand <\$3370 / mo>
- Facility peak demand <\$1354 / mo>
- Energy charges <\$2048 / mo>
- Total electric savings <\$6772 / mo>



# Economic Justification, con't

- Electric savings nearly covers gas cost
  - Does not include O & M, depreciation
  - Does not include value of heat output
- Conclusion: close enough on just the Prosperity bottom-line that we will start the CHP ASAP using natural gas.
- Planet and People bottom lines are already known to be positive



# Bio-gas Production

- Daily production (early 2003) about 400m<sup>3</sup>, gives 10 to 14 hours run time
- Anaerobic treatment plant can be doubled in size as production grows
- Other FOOD (formerly WASTE) sources include yeast, spent grain, grain dust
  - These sources require some pre-treatment before adding to digester



# Electric Power Production

- 292 kW at full power
- Annual yield from bio-gas estimated 1.0M kWh
  - Approximately 1/3 of power needs
  - 2002 total power usage ~3.0M kWh



# Electric Power Connections

- Parallel connected to utility grid
- In some applications, could be used as backup power. Facility would need isolated grouping or load control if electric power capacity could not meet maximum facility demand.
- Generator package included sophisticated control and safety system



# Electric Utility Issues

- Fort Collins Utilities was eager to make the project work
  - Appeared to have no prior experience in parallel connection at this power level
  - Regulations dating to 1992
- Opportunity exists to learn from the experiences of other utilities in the USA and the world
  - No need for every utility to re-engineer the connection and safety issues



# Electric Utility Issues,

- Host of safety requirements, some redundant to those on the generator package
  - Vector surge protection, OV, UV, Freq. ...
  - Must modulate to prevent back-feeding of power
- Hard-wired, remote controlled breaker required when necessary to isolate generator from grid.
  - Could also use LOTO



# Heat Production

- 495 kW is a substantial amount of energy, for water or building heat
- Much of the jacket heat is used to warm the anaerobic treatment ponds
- Most of the brewery's process heat needs are in the form of high pressure steam (3.5 bar)
- CHP can only produce this high of a temperature from the exhaust gas
- Our system is too small to economically produce steam from exhaust heat



# Summary



# Bottom Line for the Planet

- We diverted an organic waste stream that is energy intensive to decompose, and used it to produce electric energy, heat energy, reusable water, and organic fertilizer
- We reduced municipal energy consumption necessary to treat our water and process waste water



# Bottom Line for People

- We intellectually energized staff with a challenging and highly meaningful project



# Bottom Line for Prosperity

- Little net capitalization change
- Reduced waste water treatment fees approx. \$20,000 per month
- Reduced electric power charges approximately \$7000 per month
- Reduced water purchase fees, solid and slurry waste disposal fees
- Potential income stream from organic fertilizer production



Waste = Food



The Triple Bottom Line Works!